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February 27, 1992

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 287/92-01, Revision 1

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Revision 1 to Licensee Event Report (LER) 287/92-01, concerning a unit trip. This revision corrects a typographical error in the heading of the LER.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(iv). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

J. W. Hampton
Vice President

/ftr

Attachment

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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 3	0 5 0 0 0 2 8 7	1 OF 0 8

TITLE (4) Inappropriate Action Results In High Steam Generator Level Causing Loss of Main Feedwater and Reactor Trip

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
0 1	1 4	9 2	9 2	— 0 0 1 —	0 1	0 2	1 3	9 2		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9): N

POWER LEVEL (10): 0 9 4

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)

[ ] 20.402(b)	[ ] 20.405(c)	[X] 50.73(a)(2)(iv)	[ ] 73.71(b)
[ ] 20.405(a)(1)(i)	[ ] 50.36(c)(1)	[ ] 50.73(a)(2)(v)	[ ] 73.71(c)
[ ] 20.405(a)(1)(ii)	[ ] 50.36(c)(2)	[ ] 50.73(a)(2)(vii)	[ ] OTHER (Specify in Abstract below and in Text, NRC Form 366A)
[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (AREA CODE)
S. G. Benesole, Safety Review Group	803 885-3518

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS
F	SJ	65	G0A0	Yes	F	SH	V	A415	No
F	JK	XC	B045	Yes					

SUPPLEMENTAL REPORT EXPECTED (14)

[ ] YES (If yes, complete EXPECTED SUBMISSION DATE) [X] NO

EXPECTED SUBMISSION DATE (15): MONTH | DAY | YEAR

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

ABSTRACT

On January 14, 1992, at 1001 hours, while operating at 94% Full Power, Oconee Unit 3 tripped on loss of both Main Feedwater Pumps. Instrument and Electrical (I&E) technicians were performing trouble checks on a suspected faulty controller in the Integrated Control System feedwater control circuits. The I&E technicians used an instrument with the test leads configured for current measurement rather than voltage, causing a false signal to be introduced into the controller. This increased the feedwater flow to the 3B Steam Generator, which resulted in high levels that tripped both Main Feedwater pumps. The Emergency Feedwater System activated and the unit stabilized at Hot Shutdown. After re-establishing Main Feedwater (FDW) a trip of the 3A Main FDW pump occurred on high discharge pressure due to a problem with the FDW pump speed control. Emergency Feedwater re-initiated, the second Main FDW pump was started and Emergency Feedwater was secured. The root cause of the unit trip was Inappropriate Action, Improper or Inadvertent action, Lack of attention to detail. Corrective actions included replacement of the defective parts and installing blank plugs in the current measuring jacks of instruments when issued.

BACKGROUND

The Integrated Control System [EIIS:JA] provides fully automatic control of reactor power, steam generation rate, and generated load by processing selected signals of measured plant parameters. The Feedwater Control Subsystem [EIIS:JK] is designed to maintain a total feedwater flow equal to the feedwater flow demand. One of the tasks accomplished by the Feedwater Control Subsystem is the proper ratio of feedwater between the two steam generators. It is desirable that reactor coolant temperatures leaving the steam generators (cold leg temperatures, Tc) be equal. To prevent differences in cold leg temperatures (called delta Tc) a ratio circuit is provided. When an error signal to the delta Tc controller is generated, the feedwater flow to the steam generators is re-proportioned.

If feedwater controls fail to maintain the correct limits, a high level in either steam generator will result in an automatic trip of both Main Feedwater Pumps. The loss of both Main Feedwater Pumps results in an automatic Reactor Trip when greater than 0.5% Full Power. The loss of both Main Feedwater pumps also initiates the Emergency Feedwater System [EIIS:BA].

Main Feedwater Pump Turbine speed is controlled by the Motor Speed Changer (MSC) and the Motor Gear Unit (MGU). The MSC is used to control the speed from zero to the speed required for plant conditions. The MGU is used to control the speed from approximately 2800 rpm to the speed required for plant conditions utilizing ICS. The Turbine speed is controlled by the lowest of the two signals. When the hand jack switch is On, the MGU is turned off and the MSC is controlling Turbine speed. This allows maintenance on the MGU. It is necessary to ensure that the MSC is controlling pump speed before placing the Hand Jack Switch to On.

EVENT DESCRIPTION

On January 14, 1992, power was being increased on Unit 3 following a power reduction due to feedwater oscillations. At 0136 hours, the power increase was stopped due to secondary side flow oscillations and the 3B steam generator high level. A power reduction was started and the 3B steam generator returned to an acceptable level after reducing load. The power reduction was stopped at approximately 94.5% full power.

On January 14, 1992, Instrument and Electrical (I&E) personnel were issued a work request to investigate/repair the cause of feedwater swings encountered when taking the Integrated Control System (ICS) delta Tc controller from automatic to manual.

At approximately 0930 hours, I&E technicians began assembling the necessary drawings and instrument to trouble check a module in the delta Tc controller. I&E Technician A and I&E Vendor Technician B both reviewed the drawings and located the ICS cabinet where the module was contained. I&E

Technician A continued to look at the wiring diagram while I&E Vendor Technician B began setting up the test meter.

The measuring device was a Fluke 8600 multimeter, which is capable of measuring either voltage or current. The leads must be plugged into either the current or voltage jacks and the appropriate selections made with push buttons.

With the device placed on the floor near the ICS cabinet, I&E Vendor Technician B plugged the two attached leads into the current measuring jacks and pushed the buttons for Direct Current Volts and 20 Volts maximum. He then turned the device on. I&E Vendor Technician B states that he took the two separate leads to the top portion of the ICS cabinet and placed them in "common to out" jacks for measuring the output voltage. He looked down at the digital readout and observed no reading. I&E Technician A also observed no reading and looked at the top of the ICS cabinet. He states that he observed the leads were placed in "input to output" jacks. I&E Vendor Technician B removed the two leads from the ICS delta Tc module and returned them to the "common to in" jacks. Again no readout was observed on the digital multimeter. I&E Technician A, who was preparing to take the readings, heard some alarms in the control room and remarked that the unit had tripped. This was approximately eight seconds from the time the leads had first been placed in the ICS module jacks.

At 1001 hours, alarms were received in the control room to indicate "B" BTU limit. A high level Feedwater (FDW) pump trip setpoint was reached on both 3B Steam Generator levels (>96% on the operating range). Prior to the trip the 3B Steam Generator level was controlling at approximately 90%. Both Main (FDW) Pumps tripped at 1001:31:73 hours, which, in turn, caused an anticipatory trip of the reactor at 1001:31:87 hours.

Several immediate automatic actions occurred. All three Emergency FDW Pumps started. The Control Rod Drive [EIIS:AA] breakers opened, and all control rods were inserted into the core, shutting down the reactor. The turbine/generator tripped, station auxiliary power [EIIS:EA] switched from normal to start-up power, and the Main Steam Relief Valves and Turbine Bypass Valves opened.

The operators also took manual action per the Emergency Operating Procedure (EP/3/A/1800/001). They confirmed that the reactor and turbine had tripped, verified that the Emergency Feedwater Pumps had started, and monitored for proper operation of other automatic equipment. They started a second High Pressure Injection (HPI) [EIIS:CB] pump at 1002:13 hours and opened 3HP-26, HPI Loop A Emergency Make-up Valve, to maintain Pressurizer level. Reactor Coolant System letdown was isolated.

At 1007 hours, the operators shut down the Turbine Driven Emergency FDW Pump as directed by the Loss of Main Feedwater procedure (AP/3/A/1700/019), after confirming that both Motor Driven Emergency FDW Pumps were operating.

At 1022:04 hours, the operators closed 3HP-26 and stopped the second HPI pump. At this point the unit was stabilized.

Specific post-trip parameters remained within acceptable limits. Reactor Coolant System (RCS) [EIIS:AB] pressure increased to 2204 psig then decreased to 1809 psig and controlled at approximately 2129 psig. Pressurizer inventory remained on scale between a high of 217 inches at the time of trip and a low of 61 inches, then raised and controlled at approximately 133 inches. Pressurizer Heaters automatically turn off at a pressurizer level of 80 inches. RCS temperatures converged smoothly to approximately 550 degrees F. Steam Generator pressure reached a post-trip high of 1110 psig before controlling at approximately 983 psig. Main Steam Relief Valves reseated within minimum reseat pressures.

The 3C Condensate Steam Air Ejector (CSAE) [EIIS:SH] relief valve (3MS-70) failed open causing a lower condenser vacuum. Operators isolated Main Steam supply to valve 3MS-70. The Main Vacuum Pumps were aligned to Unit 3 Condenser and started. Vacuum returned to normal and the pumps were removed from service.

A follow-up investigation by I&E personnel found that the suspected delta Tc controller did, in fact, have an unacceptable offset.

At 1225 hours, operations restarted the 3A Main FDW pump, secured the Emergency FDW pumps and placed them in automatic per Loss of Main FDW procedure (AP/3/A/1700/019).

I&E Engineer A was monitoring the performance of the feedwater system from an on-line computer. He noticed that the operating main feedwater pump was not decreasing below 67 percent position despite a lower demand. He brought this to the attention of the reactor operators. Reactor Operator A did not observe any abnormalities in feedwater flow or steam generator level. The Control Room Supervisor gave instructions to Reactor Operator A to place the 3A main feedwater pump on hand jack, using OP/3/A/1106/02, Condensate and Feedwater procedure. Placing the pump on hand jack removes the Motor Gear Unit (MGU) from speed control and gives control to the Motor Speed Changer (MSC). The initial conditions of this procedure describe the status of the feedwater pump controls as having the MGU failed at its high speed stop. The MGU had failed, but it was not at its high speed stop. The procedure has a note that the MSC is controlling speed when the MGU trips from AUTO to MANUAL. As Reactor Operator A decreased the speed signal of the MSC, the MGU did trip to MANUAL. Reactor Operator A noticed that as speed signal was decreased with the MSC, feedwater pump suction flow decreased and, as the signal was increased, flow increased.

Reactor Operator A placed the 3A Main FDW pump on hand jack at approximately 1252 hours. Pump speed and pump discharge pressure immediately increased. The pump tripped when it reached its high discharge pump pressure at 1252 hours.

Emergency FDW pumps started and increased levels to 30 inches on the Start-Up Range, the Emergency FDW setpoint. Subsequent Actions of Emergency Operating Procedure (EP/3/A/1800/001), were performed and the Loss Of Main FDW procedure (AP/3/A/1700/019), was re-entered.

Pressurizer level decreased to approximately 90 inches. Operations manually started the 3B HPI pump and opened 3HP-26 to return the pressurizer level to normal.

The 3B HPI pump was stopped and 3HP-26 was closed when pressurizer level returned to approximately 130 inches.

At 1401 hours, the 3B main FDW pump was started and controlled Steam Generator level. The Emergency FDW pumps were secured and the preparations for start-up continued. The reactor was returned to criticality at 2252 hours.

Further investigation into the feedwater pump control circuits found a defective limit switch in the MGU.

CONCLUSIONS

The root cause of this event is Inappropriate Action, Improper or Inadvertent Action, Lack of attention to detail. The test instrument leads were inadvertently placed in the current jacks instead of voltage jacks. There was a discrepancy between the reports of Instrument and Electrical (I&E) Technicians A and B. I&E Vendor Technician B believes he placed the two leads from the multimeter in output and common, whereas I&E Technician A felt that the leads were placed in the input and output jacks. I&E Engineering felt that the most likely explanation of the resulting change in delta Tc signal was the account of I&E Technician A. Placing the leads between the input and output jacks while connected to the current measuring jacks essentially "jumpered" this device. With the offset present on the module (the original problem), this "jumpering" lead to an increase in the output signal from the delta Tc controller and the resulting increase in 3B Steam Generator level to the trip setpoint. Had the two attached leads been plugged into the voltage jacks on the measuring device, the unit trip could have been avoided. Apparently, I&E Technician A was not in control of the work being performed by the vendor technician. There had been no excessive work hours by either of the technicians and the trouble check was not on a time schedule.

Although no similar events have occurred in the past two years, a trip did occur in July 1988 due to a similar error (LER 269/88-09). While two I&E technicians were preparing to calibrate a pressure instrument, one of the technicians plugged the multimeter into the current rather than voltage jacks. The technician was counselled concerning the error. Interviews with several I&E Technicians indicate that it is not unusual for errors to occur when connecting test instruments, which indicates a recurring problem. Normally the components being worked on are out of service and no adverse consequences result. I&E is planning to place blank plugs in the current jacks of Fluke instruments when they are issued to prevent the inadvertent use of the current jacks. It is felt the blank plugs will help prevent this error from recurring.

Two additional equipment failures/problems occurred during this event, but were not causal factors of the event. Subsequent investigation revealed apparent causes of the post-trip discrepancies.

1. 3C Condensate Steam Air Ejector (CSAE) relief valve (3MS-70) was inspected by a manufacturer's representative and mechanical maintenance personnel and revealed a manufacturing defect. This failure is not NPRDS reportable. The valve is an Anderson-Greenwood type 727 pilot operated relief valve. This type of valve is utilized on Units 1,2 and 3. Since Unit 2 was in a Refueling Outage, two of the Unit 2 CSAE relief valves were inspected and revealed no defects of this type. Also, the manufacturer reports that this valve had not indicated any problems in the past. This problem appears to be isolated and no further action is required.

2. 3A Main feedwater (FDW) pump Motor Gear Unit (MGU) had a defective limit switch. The reason that the 3A Main FDW pump tripped when it was placed on the hand jack, was that the Motor Speed Changer (MSC) had not assumed pump speed control at the time the hand jack was actuated. The operating procedure specified in the initial conditions that the MGU had failed to its high speed stop, when in fact the MGU had failed to a mid-position. The result was that, when the MGU tripped to MANUAL, the operator thought he had control with the MSC, as the procedure suggested, when, in fact, he did not. The operator thought he saw positive control when he adjusted the MSC, but this may have been due to slight feedwater oscillations coincidentally occurring at the time that he manipulated the MSC. When the hand jack switch was turned on the MSC demand was at a higher speed than the actual pump speed. The pump quickly increased its speed to meet the new demand. Discharge pressure increased to its setpoint and the pump tripped.

There were two NPRDS reportable failures associated with this event. The delta Tc controller module is a Bailey Meter model number 6620770-A-111. The MGU lower limit switch is a General Electric model CR9440-KI-KI.

There were no personnel injuries, radiation exposures, or releases of radioactive materials associated with this event.

CORRECTIVE ACTIONS

Immediate

1. Operations personnel took appropriate actions per the Emergency Operating Procedure and Abnormal Procedure for Loss of Main Feedwater to bring the unit to stable conditions.

2. The 3C Condensate Steam Air Ejector relief valve (3MS-70) was isolated with manual valves.

Subsequent

1. The Instrument and Electrical (I&E) Technicians satisfactorily completed the trouble check and replaced the delta Tc controller module.

2. The 3C Condensate Steam Air Ejector relief valve (3MS-70) was replaced.

3. The 3A Main Feedwater pump motor gear unit lower limit switch was replaced.

4. The I&E Technicians have been counselled concerning their Inappropriate Action in this event.

Planned

1. I&E will establish a policy to have blank plugs installed in the current measuring jacks of Fluke 8600 multimeters when issued.

2. This incident will be communicated to all I&E Technicians noting the discrepancies and emphasizing the correct methods to be utilized.

3. The Condensate and Feedwater procedure will be revised to clarify the enclosure for placing the Feedwater Pump Turbine on the hand jack.

SAFETY ANALYSIS

Failure to properly set up a measuring device while trouble checking the delta Tc controller resulted in an error signal initiating high level in the 3B Steam Generator (SG). The high SG level resulted in a trip of Main Feedwater (FDW) pumps to prevent moisture carryover to the main steam lines.

Loss of FDW is an anticipated transient and is described in Section 10.4 of the Final Safety Analysis Report. Loss of FDW initiates a reactor trip and starts the Emergency FDW System to provide decay heat removal. In this event, all the systems and equipment operated as designed to mitigate the consequences of the Loss of FDW. The Main FDW pumps tripped as expected. Instrumentation detected the loss of Main FDW pumps and initiated the Main Turbine trip, Reactor trip, and provided the start signal to the Emergency FDW System. All three Emergency FDW pumps started and the unit was stabilized at hot shutdown.

The failure of 3MS-70 relief valve resulted in a partial loss of vacuum. The component was isolated and the Main Vacuum pumps were aligned and vacuum returned to normal. Had vacuum been lost, the main condenser would not have been available. However, steam relief through manual atmospheric dump valves was available. There were no safety consequences to the partial loss of vacuum.

The failure of the 3A Main FDW pump Motor Gear Unit lower limit switch led to a subsequent post trip loss of Main FDW. Again, Emergency Feedwater actuated as designed and provided decay heat removal until the second Main FDW pump was returned to service.

There were no releases of radioactive materials, radiation exposures, or personnel injuries associated with this event. The health and safety of the public was not affected by this event.